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ABSTRACT

This practicum addressed the problem of limited science instruction by primary teachers. The goals of this study were: (1) primary teachers would spend more time teaching science to young children; (2) primary teachers would develop expertise in their ability to teach science; and (3) students would have a positive attitude towards the subject of science. In addressing these goals, a Science Center was implemented in conjunction with teacher inservice programs designed to increase the amount of time spent in science instruction. The results confirmed that all goals were met. The teachers reported a commitment to increased instruction and more expertise along with the value of using a hands-on approach to teaching science. The students reported a positive attitude towards the subject of science. This program was also implemented in a second setting and used the hands-on approach to teaching science as an enrichment program for grades one to five. (TW)

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PRACTICUM REPORT

Center for the
Advancement of Education
Ed.D. Program

Improving the Attitudes of Primary Teachers
and Students towards Science by Using
a Hands-On Approach

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NOVA UNIVERSITY

MAR 4 1988

PRACTICUM APPROVAL SHEET

This practicum took place as described.

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Approved:

January 26, 1988 — Georgianna H. Lowen
Date of Final Approval of Report — Dr. Georgianna Lowen

IMPROVING THE ATTITUDES OF PRIMARY TEACHERS AND STUDENTS TOWARDS SCIENCE BY USING A HANDS-ON APPROACH

PRACTICUM II SUBMITTED TO THE FACULTY OF THE
EARLY CHILDHOOD EDUCATION PROGRAM
IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF EDUCATION

BY

DONALD D. DAWES

NOVA UNIVERSITY
CLUSTER 15

December 1987

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ABSTRACT

Improving the Attitudes of Primary Teachers and Students Towards Science by Using a Hands-on Approach. Dawes, Donald D., 1987: Practicum Report, Nova University Ed.D. Program in Early Childhood
Descriptors: Training Methods/Training Objectives/Teacher Training/Science Programs/Science Projects/Animal Studies/ Hands-on Approach

This practicum addressed the problem of limited science instruction by primary teachers. Through a review of the literature and a survey of programs in the writer's community, the writer found no existing programs of this nature. Most area schools were satisfied with minimal science instruction for teachers.

The writer's goals were established through the following objectives: (1) the primary teachers would spend more time teaching science to young children; (2) the primary teachers would develop expertise in their ability to teach science; and (3) the students would have a positive attitude towards the subject of science. In addressing these goals, the writer implemented a Science Center in conjunction with teacher inservice programs designed to increase the amount of time spent in science instruction.

Surveys, observations, time sheets, lesson plans, and interviews were used as the primary evaluation tools at the end of the program. The results of the majority of these instruments confirmed that all goals were met. The teachers reported a commitment to increased instruction and more expertise along with the value of using a hands-on approach to teaching science. The students reported a positive attitude towards the subject of science. The writer also implemented this program in a second setting and used the hands-on approach to teaching science as an enrichment program for grades 1 to 5.

All the participants felt that the practicum was valuable, having increased their knowledge and appreciation for science instruction.

CHAPTER I

INTRODUCTION

Writer's Work Setting

The work setting in which the writer was employed for 11 years is a private school. The school is located in a suburb, 15 miles from a major eastern city. The school is composed of three separate campuses; the writer's campus was the largest and had a student population of 525. This campus houses a lower school, of which the writer was principal, prekindergarten through fifth grades and the middle school, sixth through eighth grades. The campus is leased by the school from the local school district.

The upper school is located one mile from the writer's setting and houses ninth through twelfth grades plus the administration offices. The other lower school is also in the suburbs, 10 miles from the writer's school, and services students from south and west of this major city. After completing fifth grade, the students from this lower school then join the middle school program on the writer's campus (see Figure 1).

Figure 1

Design of Three Campus Locations

Upper School	Middle School	Lower School
Grades 9 - 12	Grades 6 - 8	Grades K - 5
	Lower School	
	Grades Pre-K - 5	

At the other lower school, there was only one section of each grade level from kindergarten through fifth grades. In the writer's school, there were two and three sections of each grade level. The total enrollment of all the schools was 1,015 students. All major decisions, such as curriculum changes, were made at the writer's campus with the staff and student body being four times the size of the other lower school. Each school was administered by a principal except the writer's school where there were two principals, a lower school principal and a middle school principal.

In each building, the faculty and staff reported to the building principal and the principal reported to the headmaster; the headmaster reported to the board. In the writer's setting, the middle school principal was in charge of the middle school faculty. However, the lower school principal was the final authority within this building. The principals were the authority in all matters of education such as policy, discipline, and curriculum. However, the faculty was involved in committee work and the decision-making process.

The socioeconomic status of the student body was a cross-section of classes. The school received students from upper and middle-class school districts as well as those from a neighboring state. In contrast, this was balanced with the inner city, low-income families of the major city and a neighboring city. This neighboring city is a severely

deprived community having the third highest unemployment rate of cities in the United States. The school received public school bus service from 19 different school districts each day.

Headmaster

The headmaster was the chief executive of the school. He was the overseer of all principals, teachers, students, parents, and office staff. The headmaster was the school's direct link to the board of education. The headmaster, along with the building principals, decided on school policies and then these policies were presented to the board for final approval. Any information from the principals, teachers, or parents would first go through the approval of the headmaster and then would be presented to the board. This process kept the headmaster informed as to what was transpiring within the individual schools. The headmaster attended all school board meetings and gave a monthly report. His position did not allow him to vote on any issue.

Faculty

Each year, faculty members are selected from varied background experiences; all teachers hold proper teaching credentials. On staff, there are former missionaries who taught in foreign countries and former public school teachers as well as those whose entire experiences have been

in private schools. Each teacher is interviewed by the principal of that level, the headmaster, and a board member. The teacher is required to sign a Statement of Faith that focuses on the unity of doctrinal beliefs within the Christian faith. Being one of the oldest and largest private schools in this area, as well as being located in the metropolitan area of a major city, enables the school to attract many qualified teachers.

Students

The school families are interviewed and children are tested before entrance. The interviewing process is handled by a member of the school board who seeks to understand the parents' commitment to academics as well as religious education. Over the years, this screening process has exposed some students and parents who do not live up to the school's expectations. There have been specific instances where the students were put on probation and, after due process, removed from the school. The school has been evaluated and continues to receive the accreditation from the Association of Christian Schools International and the Middle States Accreditation Association.

Second Work Setting

As the writer changed jobs, the last 3 months of this practicum took place in a new setting. As headmaster of a private school outside a major city, the writer became the

third administrator in the 12-year history of the school. This school began under the inspiration of a local church which wanted to expand its outreach into the community. The school is housed in the education building of the church and is used both on Sundays and during the school week.

The school is governed by a school committee made up of six members; five are school parents and one is an elder from the church. The elders of the church are the final authority of the school. The headmaster and members of the school committee are responsible for the daily operation of the school and enforce all school policies. The board of elders must approve all changes in the school program recommended by the headmaster and school committee.

The headmaster holds monthly school committee meetings, writes the agenda, and conducts the meeting. The hiring of the faculty is also done through the headmaster and school committee. The school has had very little turnover, with no new teachers being hired in the past 3 years. This factor adds to the stability of school programs. This school has received its accreditation through two major accrediation associations and is scheduled for a reevaluation in 1993. In the meantime, the school is addressing the recommendations from the last visit and plans to expand three specific areas:

1. middle school curriculum
2. early childhood education
3. extended day care for working parents and single parents

This school provides for the education of children beginning at 3 years old and continues from prekindergarten through eighth grade with an enrollment of 200 students. There are 20 full and part-time staff members with an average student-teacher ratio of 1 teacher to 17 students.

Writer's Role and Responsibilities

The writer has an Associate Degree from Pennsylvania State University, a Bachelor's Degree from Philadelphia College of Bible, and a Master's Degree from St. Joseph's University. The writer is a candidate in the Doctoral Program in Early Childhood at Nova University. His responsibilities in the first work setting were many and varied; however, only the most important ones are listed below. He was responsible for:

1. planning, delegation, supervision, and evaluation of all duties that were related to the faculty and staff;

2. periodic visitation of each classroom for the purpose of remaining informed as to what was happening in each subject area and grade level as well as for the prupose of teacher evaluation;

3. personal conferences with each teacher (a minimum of twice a year) for the purpose of teacher evaluation, school philosophy, and discussion of the overall school program;

4. presentation of needs and interests of the staff to the headmaster;

5. scheduling and conducting purposeful teachers' meetings and inservice programs;

6. maintaining all records and reports required by local, state, and national agencies as approved by the board;

7. assignment of various duties among the staff to insure the smooth, safe operation of the school;

8. interviewing all prospective teachers and contacting listed references;

9. supervision of all entrance testing;

10. disciplinary action given to students.

In the writer's present setting, the headmaster position is the chief executive officer of the school. He, too, is responsible for the jobs described previously and is the authority under the approval of the school committee and board of elders.

CHAPTER II

STUDY OF THE PROBLEM

Description of the Problem Situation

During the past few years in the writer's school, it had become evident that there was very little science instruction given in the primary grades. This situation was due to several factors:

1. The school board had placed emphasis on the "back to basics" in education and had expanded the requirements for reading and mathematics instruction. This emphasis was a result of standardized test scores that had dropped and a new program in the State of Pennsylvania--Testing of Essential Learning Literacy Skills (TELLS)--which helped identify students needing remediation in math and reading. The TELLS program is a statewide program under the Commission of the Governor of the State.

2. As a result of the expanded reading and mathematics time, teachers had the freedom to teach science as time allowed. This resulted in an average of 30 minutes of science being taught per week.

3. The Silver Burdett text (1978) was the science curriculum used in the primary grades. This text offered very little "hands-on discovery" approach to science. The teachers were encouraged to expand on this curriculum, but very few actually did.

4. The teachers expressed a lack of confidence in their ability to teach science.

The writer recognized a need for more science curriculum of high interest to be taught in the primary grades. Little time was given to science instruction as a result of the aforementioned factors. The problem of teachers having little time and feeling insecure and inadequate in the knowledge and methods of science instruction resulted in there being very limited science instruction.

Documentation of the Problem

In order to substantiate this problem, the writer interviewed 4 students from each of the eight primary-grade classrooms. The 32 students also responded to a Student Survey Questionnaire (see Appendix A). From these interviews, the writer concluded that little time had been spent in the teaching of science; however, the students indicated a desire for more science instruction.

The teachers of the primary grades also responded to a Teacher Survey Questionnaire. The results of their responses substantiated the need for increased science instruction (see Appendix B):

1. Out of 11 responses from primary teachers, all of them rated science as the least important subject taught at their grade levels. All of the primary teachers also stated that science was the subject they least liked to teach.

2. Science was one of the subjects mentioned by all of the primary teachers as the subject that they felt least prepared to teach.

3. Some of the suggestions to help improve science instruction included: inservice programs, separate science room, hiring a teacher to teach only science, more materials, more planning time, and team teaching.

4. The primary teachers also responded to the question regarding time given to science instruction which varied from 20 to 60 minutes per week. The average class had approximately 30 minutes of science instruction per week.

In addition to the questionnaires, the writer interviewed a principal from another school. J. Chase (personal communication, September 1986) stated that science instruction suffered in her setting because of the lack of preparation time given to primary teachers. Not being committed to the discovery method of science instruction, teachers' lack of supplies, room space, and knowledge, in addition to preparation time, all contributed to inadequate science instruction.

The problem was that too little time was spent in the teaching of science in the primary grades.

Analysis of the Causes

There were several reasons why science had been given a low priority among the primary teachers. One reason was

that science was not tested on the standardized test given by the writer's school; therefore, teachers were not accountable for the subject. Another reason was that student progress in science was difficult to evaluate. In addition, teachers lacked supplies, training, and preparation time.

Therefore, the emphasis of the school was on reading and math scores, and the administration and board held teachers accountable for high scores in these subjects. Hence, the amount of time teachers spent instructing students in reading and math was significantly more than in the teaching of science.

A third reason why science had been given a low priority was that student progress in science was difficult to evaluate. The grading system in the primary grades was highly subjective--satisfactory/unsatisfactory. There were very few written evaluations received by the students concerning the skills being taught. Most of the teachers' evaluations of students' understanding of the skills came from informal discussions and questioning. Consequently, it was conceivable that a student could receive a satisfactory grade without complete mastery of the skills taught during a marking period.

Finally, only 5 to 10% of the curriculum budget was specifically spent on science supplies. This small amount was not enough to support a quality hands-on science program

in the school. To operate a quality program, a 60% increase would have been required in the amount of money budgeted for science materials.

In conclusion, the emphasis on reading and math standardized test scores, limited teacher accountability for teaching science to students, a subjective grading system for students, and limited funds were the causes for little science instruction in the primary grades.

Relationship of the Problem to the Literature

Research confirmed that there is a problem in most elementary schools throughout the country dealing with the teaching or lack of teaching science in the elementary grades. Some of the reasons for this are:

1. poor preparation and training given to teachers resulting in scientific illiteracy;
2. limited number of inservice programs in science;
3. lack of a priority given by administrators of these elementary schools;
4. not enough time allocated each day for science, which is often considered a minor subject;
5. lack of high-interest science materials for both teachers and students beyond the textbook.

Many studies focused their attention on scientific literacy in the 1980s. Lederman (1986) found that public schools have failed to provide students and teachers with

adequate knowledge and understanding of the nature of science. Even basic skills such as the importance of asking questions which lead to students' desire for further investigation are limited in science teachers (Allison & Shrigley, 1986).

Well planned, structured classes in science will produce the desired outcome of scientific literacy. Methods of teaching science, such as the inquiry method, do not just happen but must be understood, planned, and developed by the teacher. As a result, the collection of data, asking of questions, and further investigation will take place (Yore, 1986). Science is an open area of curriculum which can be integrated and expanded to other areas of study (Petty, 1985).

Rakow (1984) tested 2,000 9-year-old students who were randomly selected from across the United States in order to measure their attitudes and achievements in the area of science. He found a growing sense of mediocrity in elementary science. Rakow suggested that the elementary schools, with their present curriculum, are not the source for scientific literacy in children. He stated that science educators must reassess the influence that out-of-school and beyond-the-textbook science activities can have on shaping the attitudes and knowledge of their students. Rakow concluded that the students involved in the study pointed toward a growing sense of pessimism concerning their

abilities to use science to solve world problems or as a possibility for future vocations.

An important approach to curriculum development must include inservice for teachers as well as the evaluation of the curriculum. Teters, Gabel, and Geary (1984) cited a cross-section of science teachers surveyed as to what improvements could be made in science instruction. The survey, conducted by the National Science Teachers Association, included items such as:

1. topics taught at which grade level;
2. criteria for selecting curriculum;
3. methods of instruction;
4. what hampers science instruction;
5. time devoted to teaching science;
6. what program is being used in the school.

The purpose in conducting this survey was not only to find out what was being done in the area of science curriculum but also to develop workshops to enable the teachers to improve their science teaching. The topics that most elementary teachers presented were in the area of physical and earth sciences. The hands-on approach was the most common method of instruction in elementary science. Small group activities also took place in 50% of the schools surveyed. The results of the survey stated that teachers need better science kits and teacher guides in order to do

their jobs better. The lack of supplies and space were also problems recorded by a large percentage of the teachers.

Attitudes of teachers and administrators also hinder science instruction. Schoeneberger and Russel (1986) found that in many elementary schools a teacher could go for as long as a year without teaching science and have no questions asked by parents or administrators. From the teacher's point of view, studying science seemed to be an added frill if time allowed. In this study, teachers expressed the problems of personal confidence, availability of equipment, and time constraints as limiting factors.

In another study of elementary teachers, science instruction was coordinated with the teachers' attitudes, backgrounds, and personal characteristics, all of which affect science education in their settings (Lawson, Costenson, & Cisneros, 1986). Kobulla (1986) referred to a direct relationship between the attitude toward science and the actual amount of instruction given in class. This author felt that if the desire and commitment were not there, very little teaching of science took place.

Yeany and Padilla (1986) suggested that the following steps be given to all science teachers for inservicing: self-analysis, observing models of teaching, analyzing models, and practice with feedback. The textbook approach to teaching science has reinforced the problem of low interest in the science curriculum in elementary schools.

With poor readers, science class again becomes a setting for frustration and failure when only a textbook is used.

Many researchers expressed the need to teach science beyond the textbook in a hands-on approach. Borst (1986) found that labs and hands-on experiences, in addition to textbook learning, became the combination tool for students to grasp and maintain the science material presented. The emphasis on mastering a textbook during the course of a year resulted in decreased student interest and lack of concept learning (Yager, 1986). By incorporating knowledge of day-to-day experiences beyond the science textbook, positive results will be naturally produced.

Yager (1986) found that students learned more science from hands-on experiences and interaction with one another than in isolated science classrooms of traditional schools. It is important to take science outside the classroom and thus build a student's awareness and knowledge as well as appreciation of the student's world.

Strunck (1986) recommended from his research that elementary curriculum changes need to be made in two areas of science: hands-on activities and outdoor education. Lind (1984) maximized the natural curiosity of children and their desire to know and explore the world around them. According to Lind, the excitement of "finding out" is a basic, multisensory approach and a natural activity for

children. Through the use of all their senses, children can discover and retain knowledge of the world around them. By looking, tasting, feeling, and learning, young children can develop deeper understanding of their world by doing exactly what is natural to them, using their senses.

In addition to these recommendations of broadening the science curriculum from the textbook aproach, many schools have developed programs of high interest involving the study of live animals and a hands-on approach. Jones (1986) reported on a hands-on approach to teaching animal studies in science in which a Canadian school developed an animal lending library. A minizoo in the school library provided students with hands-on experience with live animals as well as books on the care of these animals. For two weeks at a time, the animals were in the care of a student. The student had to follow written instructions of daily tasks and then he/she recorded observations. The animals were also checked out by the classroom teachers for a period of time. Gains were made not only in the knowledge of animals but also with introverted children who often used the classroom pets as playmates.

"It doesn't take a visitor long to notice the excitement in learning that comes from children's active involvement with animals" (Alt, 1985). The "Fish Lab" was the name of an extracurricular science club in an elementary school in the Rocky Mountains of Colorado. Within this school,

there were 40 aquariums of various sizes (10 to 100 gallons) housing fish from all over the world. Everything pertaining to the care of the fish was handled by club members. The students met either before or after school each day to care for their aquariums. There were regularly scheduled classes (club meetings) for the members each week. Students had opportunities to share their knowledge with one another and receive instruction from the teacher.

The enthusiasm for this club was great, stated Alt (1985). The students spent any free time they had observing their fish and understanding how to maintain an underwater environment. This club provided enjoyment for everyone in the school as it helped to create an atmosphere of serenity, yet a stimulating environment.

Meshover and Feister (1968) cited an example of a high-interest science project including the study of guinea pigs. The teacher developed a unit based on the needs of guinea pigs. By researching materials, the students quickly learned, and became actively involved in, the care and needs of guinea pigs. The animals became classroom pets that were cared for with much excitement by the students. The study also included the raising of baby guinea pigs in the classroom. The authors stated that the entire school was talking about what was going on in the classroom.

Another example of high-interest animal study included birds. Corral (1983) stated that student interest is

certain to soar when a course is presented on the subject of ornithology. Animals are naturally interesting to children and, as a result, students hardly recognize that they are also learning the science skills of inquiry and analysis. The program ran one full semester and took place both in and out of the classroom. Many field trips were an important part of the curriculum. Within the program of study, the students participated in hypothesizing, collecting and analyzing data, and drawing conclusions. The program lent itself to exercises where students worked in groups, and together they came in touch with the world of nature.

Corral (1983) expanded his ornithology course to a feeding station. In this setting, the students developed the ability to observe and identify different types of birds. The feeding station course took place totally outdoors. By setting up numerous feeding stations, the students became familiar with the food preferences of the birds as well as the species of birds that do not migrate over the winter months. Beyond learning the birds' preferences for food, the students also observed behaviors such as dominant aggression. Over a period of time, the students were then required to write up detailed lab reports that followed the conventional scientific formula of introduction, methods and materials, data and discussion. From these exercises, Corral found that students grew in

their writing and observation skills and had an enjoyable time learning.

Science education including animal studies provides high interest studies for students. Wandersee (1986) reported learning preferences of students included animals, their movement, life cycles, communications, mating, giving birth, and raising of their young.

Many ecologists stated that the future of many endangered species lies in the education of our youth. Children need to know that if one does not protect endangered species, they will become extinct. Joyce (1986) stated that beach and sea-living creatures are greatly endangered by land developers. The effect goes on and on. As sea life changes, so do birds who depend on sea life for food.

Scheel and Ross (1986) found that some species of birds such as the California condor are dependent for survival on the intervention of man. Cherfas (1986) and Ryall (1986), as ecologists, stated that people are responsible for intervention and the balancing of animal population; otherwise, the extinction of certain species is inevitable. Levin (1986), as a naturalist, stated that educating the public as to the severe danger many animals are facing for survival is humankind's only hope.

Basically, very little is known in the dynamics of ecological communities; the gap between what is known about

animals and their natural habitats and what remains to be known is overwhelming. Levin (1986) estimated that only 1 species in 10 or 12 is even known in the world of animals and insects. Education becomes the only tool for survival.

Science also needs to be presented as a valuable tool for preparation for life. Block (1986), who received the Presidential Award for Excellence in Science Teaching, still senses that science is the stepchild of all curriculum. He stated that science is the study that affects the life of every student. Pollution, life cycles, weather, and animal studies are most interesting to students; and the information gained is carried from the classsroom to their world.

Teachers need to develop creative ways of enriching the science curriculum. Teachers should become better prepared, motivated, and committed to the subject of science for the sake of their students. Even a simple start such as a walking field trip has benefits. Wood (1986), in her consulting work, found that school budgets were increasingly light; and, therefore, funds for field trips were reduced to one per year. A creative approach was to design walking field trips close to the school. By evaluating the immediate community of the school, three fourth-grade teachers developed field stations. These stations included plant and tree studies, rock studies, bird studies, and a

scavenger hunt. The outdoor education greatly enriched the science curriculum.

From the literature, it can be concurred that scientific learning can be accomplished through inservicing of teachers, expanding the curriculum beyond the textbook, and providing high-interest, live animal studies.

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectations

One goal of this practicum was for primary teachers in the writer's school to spend more time teaching science to young children. The writer also expected the teachers to develop confidence and expertise in their ability to teach science and therefore make the teaching of science a higher priority in their instructional time.

Even though many of the teachers expressed their lack of training, the writer expected them to develop confidence and positive attitudes through inservice programs and high-interest, hands-on animal studies.

Behavior Expected

It was expected that six out of eight teachers would increase their teaching of science to 1 hour per week. Through the model teaching by the writer, along with the inservicing and the fully equipped Science Center, the natural result would be more science instruction given in each class. It was also expected that with the support given to the teachers, all eight teachers would increase their expertise in science instruction by scoring 80% on the Teacher Evaluation Check List (see Appendix C).

Six out of eight teachers would frequent the Science Center in addition to their regularly scheduled classes. All eight of the teachers would also develop a unit of study

that would be well planned and taught to the other primary classes.

As a concomitant benefit, it was also expected that the students would demonstrate that their knowledge of animals had increased as a result of the animal studies by improving their score on a posttest for each unit. Along with the students' knowledge, their interest and attitudes in science would increase, as assessed by a Student Survey Questionnaire (see Appendix A), as the curriculum was developed with high-interest studies (see Table 1).

Mechanism for Recording Unexpected Events

The writer was to document unexpected events in his weekly log (see Appendix D).

Measurement of Objectives

The primary teachers would demonstrate that they were spending more time teaching science and have more expertise in their ability to teach science through written responses on the Monthly Time Sheet (see Appendix E) and the Teacher Evaluation Check List (see Appendix C) which the writer gave at the beginning and at the conclusion of the program. The teachers would also demonstrate their knowledge of science by developing a unit of study and submitting their lesson plans (see Appendix F) to the writer one week prior to the scheduled teaching time. Also, the teachers would

Table 1

Performance Objectives and Assessments

Expected Behaviors	Assessment Techniques	Standards of Performance
The primary teachers as a result of the animal science program, would spend more time teaching science to young children.	The teachers would submit a monthly time sheet indicating the amount of time spent in teaching science, and the writer would observe two lessons each month.	Six out of eight teachers would increase their science instruction to a minimum of 1 hour per week.
The primary teachers as a result of the science program, would develop expertise in their ability to teach science.	The teachers would demonstrate their approach and effectiveness in the classroom during two observation periods by the writer.	All eight of the teachers would indicate that they had increased expertise in their ability to teach science by scoring 80% on the Teacher Evaluation Check List.
The students, as a result of the science program, would have a positive attitude toward the subject of science.	The students would respond to a Pre and Postcheck List.	125 out of 210 students would respond positively on two additional items on the Postcheck List.

demonstrate that they were teaching more science by using the Sign-Up Sheet for the Science Center (see Appendix G).

The writer was to evaluate the students' knowledge of animals through a unit test developed by the writer. The test was to be administered before and after the instruction (see Appendix H). At the beginning and end of the program, the students were to complete a Check List (see Appendix I) developed by the writer to measure their attitudes towards science.

The information collected from these evaluation techniques--Student Survey Questionnaires, Pre and Postcheck Lists, Sign-Up Sheets and the lesson plans--were to be analyzed to discover if this practicum made a difference in the writer's setting where science instruction was lacking.

Because the writer unexpectedly completed this practicum in a new setting, one additional objective was added to his program (see Table II).

Table II

Additional Objective in Second Work Setting

Expected Behavior	Assessment Technique	Standard of Performance
The lower school teachers, as a result of the Animal Science Enrichment Program, would have a positive attitude towards hands-on science instruction.	The teachers would provide feedback on the questionnaire given at the end of the study units.	All five teachers would record favorable responses to the Animal Science Enrichment Program

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluation of Solutions

The problem of limited science instruction in the primary grades generated many possible solutions. One solution which the writer felt could be workable in his setting was the use of resource people such as the curator of the Philadelphia Zoo or perhaps other resource people with special animal programs sponsored by the Zoological society. The students would benefit from these resource people's expertise; however, this would not give the teachers the experience of developing a unit of study and would only be a one or two-time event.

Another option was to hire a science teacher for the primary grades. This option was not economically feasible within the writer's setting.

Still another solution (Corral, 1983) was to use the outdoors for the study of animals. According to Corral, animals are naturally interesting to children; therefore, learning about them is very enjoyable. Corral stated that studying animals in their natural habitats is most beneficial. This solution, though very interesting, did not take into consideration the time restriction or the location of the writer's school which was in an urban setting, and this could not be pursued as an option.

Teters, Gabel, and Geary (1984) researched science programs across the United States and found that teachers

need motivation and training as well as better teaching objectives in order to do their jobs well. Although the writer considers inservicing of teachers to be valuable, an extensive inservice program was too expensive as a non-budgeted item. The writer does consider inservicing as a basic requirement in order to begin any improvement program in science.

Description of Selected Solution

The writer selected a solution to his problem which would meet the proposed objectives. This solution included the development of a Science Center in a classroom next door to the writer's office. The Center housed all of the live animals selected for study during the school year. These animals included birds such as cockatiels, doves, and finches; rabbits; tropical fish; turtles; and butterflies. The life cycles of all these animals were studied. In addition to the animals, all other science equipment was housed in the Science Center. This equipment included materials for the study of water, air, weather, light, heat, magnetism, electricity, solar systems, and populations and classifications of animals and plants. It was the writer's desire that all science instruction would take place in the new Science Center at scheduled times (see Appendix E).

The science curriculum was enriched by the study of live animals. All the animal instruction was given by the

writer. The primary faculty were given four inservices, two by the writer in the Science Center. At that time, the faculty became familiar with the materials available for instruction. The discovery, hands-on approach was modeled. The writer taught the animal study units because of his personal background in agriculture and knowledge and love of animals. Several individual teachers expanded the writer's lessons in the regular classroom.

Each teacher was asked to choose a science topic, e.g., electricity, plants, or health, and to develop a unit of study to be taught to the other primary classes (see Appendix F). This assignment was designed to motivate the teachers to be well prepared in their teaching, as they were responsible for instructing other classes in a particular area of science. This experience helped to develop the teachers' abilities to teach science using the discovery approach. The teachers chose to develop a science unit to teach to the other classes of the same grade level. When needed, the writer provided coverage for the regular classrooms while the teachers instructed other students in the Science Center. The Center was available to the teachers on a sign-up basis and housed all the materials needed to provide hands-on science instruction. Occasionally, a teacher requested to give her instruction in her regular classroom because of the convenience.

Two other inservices by a guest lecturer were planned to motivate the faculty in the area of science instruction. As the result of the Science Center, inservice, and the units of study prepared by the primary faculty, the writer saw increased enthusiasm for the subject of science on the part of the faculty and students. The writer monitored the scheduling of the Science Center as well as provided coverage for the individual faculty members to teach their science unit to the other classes. The writer was also responsible for the maintenance of the Science Center including the feeding and cleaning of the animals with the help of volunteer parents and students.

The writer enriched the program during the year as he learned of qualified members of the school community to act as guest lecturers in specific areas of science instruction. Field trips to local farms, the zoo, and the planetarium also provided enrichment to the science program. The creation of a Science Center enhanced students' natural interest. This solution was economically feasible, and the room provided the environment needed for teaching a high-interest science curriculum.

In September, the writer changed his setting and began his new position as headmaster. Since this school had only one class per grade, he expanded his animal studies throughout the entire lower school, grades 1 to 5. The practicum

became an enrichment program taught one day a week and supplemented the existing science curriculum.

The new objective was to demonstrate the hands-on approach to science instruction and also to demonstrate the value of live animal instruction in the classroom. This objective was modeled by the writer giving the instruction each week.

Report of Action Taken

The plan to implement the hands-on approach to science curriculum began in January 1987. The writer informed his headmaster of the program and explained the design and goals for the year. The headmaster, upon seeing the Science Center fully equipped and without requiring funds from the school budget, gave full support to the program prior to beginning its implementation.

The course of action took place in the following order:

1. During the 1985-86 school year, the writer took a survey of faculty members as to their evaluation of the time spent in teaching science (see Appendix B). The survey showed, as the writer expected, that the science instructional time was very minimal compared to the other disciplines taught. The survey also demonstrated that the subject of science was considered a low priority and that the teaching staff in the writer's setting did not feel as competent in the teaching of science as they did in other

disciplines. Also, four students out of each primary class were given a survey questionnaire as to their attitudes towards the subject of science.

2. During the first 4 months of the 1986-87 school year, the writer choose a room and began to equip the room with old and new science equipment including live animals. The writer gave two inservices and informed the faculty of the goals of his practicum. The writer also used two guest speakers to inservice the faculty and motivate them in the values of science instruction in the primary grades. The faculty became familiar with the Science Center and, in the fall, began to use this resource room to teach their classes.

3. The writer evaluated the primary teachers during a science lesson and looked for specific areas indicated on the Teacher Evaluation Check List (see Appendix C). A score was assigned to each teacher from this evaluation. The primary students' attitudes towards science were evaluated by a pretest read orally to them by the writer. These scores were used to compare attitudes in the posttest at the conclusion of the practicum.

4. The program was implemented and the writer taught the animal science classes each week to the primary students. Activity sheets and quizzes were given to help the writer evaluate the knowledge gained by the students during the animal studies. The teachers were responsible to

keep records of their use of the Science Center by signing up for this room (see Appendix E) as well as recording the amount of time spent in science instruction each week. These records were collected by the writer at the conclusion of the program. The writer also observed two science classes to see if the hands-on approach was being incorporated in their science instruction.

5. The primary students were given a posttest to evaluate if their attitudes towards science had improved during the practicum implementation period.

6. The program was evaluated by the faculty in the June faculty meeting at the end of the school year. The writer recorded this feedback in his weekly log (see Appendix D). The program was also discussed and suggestions were made to incorporate other grades in lower school (including kindergarten) in the animal studies.

The writer kept a weekly log regarding the science program. The log included various events, reminders, and observations of the practicum. There were no unanticipated problems with the practicum. Everything was recorded as a success with some of the major highlights being as follows:

1. Rabbits, doves, cockatiels, and fish all reproduced in the Science Center during the school year.

2. Many parents visited the Science Center and discussed the program with the teachers and the writer.

3. Two board members of the school came to observe the teaching taking place in the Science Center.

4. The writer observed in many of the primary classrooms follow-up activities related to the animal studies incorporated within other subjects such as language arts and art.

5. Interest was expressed by teachers of older students who also wanted them to visit the Science Center and receive animal instruction.

In September 1987, the writer began his science enrichment program in his new setting. This private school is located north of a major city and attracts 200 well qualified students from middle class suburbs and rural settings. The student body is composed of less than 10% minorities who come from an urban setting. There is one class per grade from prekindergarten through seventh. The class sizes range from 12 to 25 students with the average class having 17 students.

Since there were no empty classrooms, the writer shared a classroom with the science teacher of grades 6 and 7. The animals were introduced for one month at a time and will remain in the science room for the students' enjoyment.

In September, doves were studied and each week the writer took the doves to the classrooms of grades 1 to 5. The birds remained in the classroom for the day and the writer then returned them to the science room. The birds

laid two eggs on October 2 and 3 and one hatched on October 16.

During the month of October, grades 1 to 5 studied finches and the three pairs of birds visited three different classrooms for a week. These were the babies that were hatched last spring in the writer's previous setting. A pair of breeding finches was housed in the science room and the entire school awaits the five eggs to hatch. The birds in the classroom enabled the children to experience the care and feeding of these pets.

November was the month for rabbit study. The dwarf female from last year was brought to the school. She was bred and baby bunnies were born the first week in December.

The students were given review activity sheets to measure their new knowledge of the animals studied.

The following schedule is planned for the remainder of this school year:

December	continue rabbit studies
January	cockatiels
February	gerbils
March	monarch butterflies
April	endangered species
May	insects (Robbins Park field trip)
June	farm animals (4H center field trip)

CHAPTER V

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Results

The focus of this practicum was to improve the attitudes of teachers and students towards science by using a hands-on approach to teaching science which involved the teachers' use of a school Science Center developed by the writer. The results recorded in this chapter indicate a favorable response to this practicum in the writer's setting.

The first expected goal of this practicum stated that primary teachers would spend more time teaching science to young children, thus making the teaching of science a higher priority in their instructional time schedule. The instrument used to measure this was a monthly time sheet indicating the number of minutes spent in science instruction (see Appendix E). The standard of performance was met, as seven of the eight teachers indicated that they had increased their science instruction to a minimum of 60 minutes per week except for the month of June.

Several teachers increased from no science instruction during the first semester to at least 60 minutes per week during the second semester. Team teachers also taught their science classes together with hands-on lessons, movies, and guest speakers. Science classes were expanded and carried over into other academic disciplines such as language arts. Table 3 illustrates the average minutes of science instruction given by each primary teacher.

Table 3

Average Minutes of Science Instruction per Week

	January	February	March	April	May	June
Grade 1						
Teacher						
A	60	75	60	90	90	60
B	45	30	45	60	30	30
C	75	75	75	60	90	30
Grade 2						
Teacher						
D	90	75	75	75	90	60
E	60	90	120	120	90	30
F	90	60	70	120	60	30
Grade 3						
Teacher						
G	65	90	120	90	65	20
H	60	90	90	75	60	35

Note: Total number of minutes include the science instruction given by the writer to individual classes on animal studies.

The second expected behavior stated that the primary teachers, as a result of the science program, would develop expertise in their ability to teach science. The results of this second objective were measured by a 10-question Teacher Evaluation Check List which was given at the beginning and at the conclusion of the practicum. All eight of the teachers recorded increased expertise in their ability to teach science by scoring 80% or higher on the Teacher Evaluation Check List (see Appendix C).

Table 4 illustrates the results from the pre and post-Teacher Evaluation Check List. The increased scores ranged from 5 to 25% and all eight teachers evaluated themselves as developing their expertise in teaching science. In addition to this, the writer also visited the eight classrooms to verify that the teachers were actually teaching and developing high interest, hands-on science instruction. Comments from these visits are recorded in Appendix J.

The third expected behavior stated that the students, as a result of the science program, would have a positive attitude towards the subject of science. The reults of this objective (see Table 5) were measured by the student responses on a pre and post-Survey Questionnaire (see Appendix A). The standards of performance were met for this objective as 182 out of 210 students recorded an increase of at least two additional positive responses on the questionnaire.

Table 4

Results of Teacher Evaluation Check List

Teacher	Pretest	Posttest
A	70%	80%
B	55%	80%
C	80%	100%
D	75%	90%
E	95%	100%
F	95%	100%
G	60%	80%
H	70%	80%

Table 5

Results of Student Pre and Post-Check List

Grade 1	No. of Students	Conclusions
Teacher		
A	27	51 out of 69 students in-
B	20	creased a minimum of two
C	22	additional positive responses
Total:	69	
Grade 2		
Teacher		
D	29	75 out of 77 students in-
E	27	creased a minimum of two
F	21	additional positive responses
Total:	77	
Grade 3		
Teacher		
G	32	56 out of 64 students in-
H	32	creased a minimum of two
	—	additional positive responses
Total:	64	

Note: 182 out of 210 students increased a minimum of two additional positive responses

The writer kept a weekly log of incidents, observations, and feedback that occurred during this practicum (see Appendix D). Several positive highlights of the science program included:

1. letters and comments from students and parents as to their enjoyment of the Science Center;

2. the excitement in the entire school when new baby birds hatched or when the rabbits and fish had babies;

3. much interest from older students in fourth and fifth grades desiring to visit the Science Center and hold the animals;

4. the Science Center became a very positive place in the school where children were happy, smiling, and learning how to care for animals and where they developed love for them;

5. additional interest was expressed in the Science Center by both the students and faculty of the middle school (lower and middle school are housed in the same building on different floors);

6. the writer became a consultant for many families as they discussed their family pets with him;

7. other grade levels not involved in this practicum purchased pets such as fish, gerbils, and rabbits to be kept in their classrooms;

8. excellent feedback was received from the teacher who continued the program during the ensuing school year;

9. parents throughout the year stopped in the writer's office and asked if they could see the Science Center that their children loved to talk so much about at home;

10. support staff, such as the librarian, did extra research to provide additional materials for the writer to use in the Science Center; this was initiated by the librarian;

11. 78 thank-you notes were received by the writer for his involvement in the teaching of science from teachers, students, and parents;

12. two board members visited the Science Center during science classes and reported to the rest of the board the positive learning that was going on in the school.

The Science Center was located next door to the writer's office. This enabled the writer to check on the animals periodically throughout the day. The Science Center was also located on the same floor as the middle school students and, upon request, the writer was able to share the room with these students. Four students were allowed in the Center at one time, unsupervised, to observe and pet the animals. The middle school students spent their study halls as well as before and after-school time in the Science Center.

The writer assigned the specific jobs of feeding the animals and cleaning their cages which were taken very seriously by the middle school students. During the entire

year, the writer never once saw a student mistreat or harm an animal. Only one catastrophe occurred when two diamond doves escaped to freedom out the window while their cages were being cleaned! The doves never returned.

The Science Center became the most popular room in the school and many older students developed an interest in animals and purchased their own pets during the 1986-87 school year. As the population of birds, rabbits, and fish grew, selected students and faculty members took home new pets for their families. Written permission was required from parents before the pets went home.

Over the summer months, the writer made himself available to the students who took pets home from the Science Center. The writer also contacted the seven students who took pets home. The writer asked the students to write to him describing the biological changes in their pets. Several children also initiated telephone contact with the writer over the summer. Some of the parents also expressed to the writer the enjoyment their family was having with their new pet. One student's parents built a pond in their back yard to house their new goldfish. Other parents built elaborate cages in their homes and yards for their pets. The writer visited two of these homes.

In September, the writer began a new position in another private school, grades Pre-K to eighth. In this setting, the writer expanded his program to the entire lower

school (grades 1 to 5). Since the science curriculum had already been selected, the writer adapted his practicum as an enrichment program designed for one period per grade per week. In this manner, the writer was able to introduce his program without interruption of the already selected and scheduled curriculum. As in the previous setting, the animal studies taught by the writer were positively received by the new faculty and students as supported by the questionnaire results (see Appendix K). The program offered several immediate positive results:

1. The writer was able to have contact with each class in the lower school and, as a result, he learned every child's name and the students learned who he was.

2. The animal studies were exciting to the students and they made comments to the writer and classroom teachers. Several children asked if they could have science every day.

3. The writer also was able to model the hands-on approach to teaching science to his teachers and also validated his expertise in the area of science instruction to his new faculty.

4. Parent responses were favorable, as the school had not experienced any live animal instruction in the past.

Conclusions and Recommendations

Upon analysis of the results of this practicum, it is concluded that the hands-on science instruction including

the development of a Science Center can benefit a school in a variety of ways. A major goal was to improve the attitudes towards the teaching of science with the hands-on approach using high interest animal studies. Many responses are difficult to measure but the writer can conclude with Rothman (1986) that the heavy reliance on textbook reading rather than hands-on, activity-based learning is not a child-centered method of teaching science. The secret of the success of this practicum was to model for the teachers the hands-on approach and allow them to see the positive student responses.

As a result of this experience, the writer plans to continue and refine the quality of the science instruction through using new materials and resource people. The program brought to the writer's attention faculty members and parents who have the expertise to act as resource people.

The Science Center, where science materials and animals are kept, makes it an exciting and different place for teachers and students. It is important that the care of the animals, including their feeding and cleaning of the room, be organized so that the children, rather than adults, assume the responsibility. Older students as well as parents were very willing to assume this kind of responsibility.

The writer recommends that a fund-raising effort be devised to purchase supplies, food, and animals. For this practicum, the writer organized a candy sale in which each participant sold one box of M & Ms. The income from the candy sale was more than enough to buy materials, animals, and food for the entire school year without making this program a budget item. Over $300 remains as a fund to use during the 1987-88 school year.

The writer has been notified that a second-grade teacher in his previous setting is continuing the animal studies. The writer will supply the teacher with materials and animals for her program.

Dissemination

The writer plans to disseminate his practicum report to the faculty members of his school. A copy of the practicum will also be placed in the lower school library for the reference use of future faculty members. The writer will also present his abstract to the faculty during September staff meeting and to the school board members who showed interest in the development of his practicum and who visited the Science Center. The writer will also mail his abstract to his fellow Cluster 15 members in December 1987.

Other plans for the dissemination of this report include the sharing of the abstract with fellow principals of the Delaware County Christian School Principals Associa-

tion. In addition, this practicum was presented at the East Coast Association of Christian Schools International Conference held in Langhorne, Pennsylvania, in July 1987.

The writer has been contacted by the Delaware County Director of 4H. This practicum report will be shared and possibly adopted by the 4H program and disseminated through Delaware County public and private schools as a new 4H "Club in the Classroom" project. The director has also discussed with the writer the designing of this practicum into a summer camp program where classes involving farm animals and pets will be given. The writer hopes to design and implement this program during July 1988.

The writer was also contacted recently by a friend who works at the A. I. duPont Institute for Handicapped and Terminally Ill Children. His practicum was described and he will present a program of pet therapy to the board of directors at one of their winter board meetings.

Finally, the writer has several educator friends who have visited the Science Center and have requested a copy of this practicum. The writer has also been contacted by the Early Childhood Program Committee of the Association of Christian Schools International to present this practicum at their spring 1988 conference in New England. Any future opportunities will be followed through by the writer regarding the dissemination of this practicum.

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APPENDIX A

STUDENT SURVEY QUESTIONNAIRE RESULTS

Appendix A

Student Survey Questionnaire Results

Name _____

Grade _____

Date _____

1. How do you feel about science?

I like it.	6	Good.	7
I like it a lot.	2	Love it.	4
I like it a little.	1	It's great.	1
Happy.	3	O.K.	2

2. Would you like to have more science taught in your grade?

Yes.	28	If it's not too hard.	1
Yes, if we could study animals.	2	I study science at home with my parents.	1

3. How much time did you spend last year in science classes each week?

10 minutes.	4	No science in kindergarten.	10
10-15 minutes.	1	Not much.	1
15 minutes.	3	I didn't have science.	4
5-10 minutes.	1	Little bit.	2
I didn't go to this school.	6		

4. What do you like about science classes?

Studying plants and reading. .	3	Doing projects.	4
Animals.	12	Studying rocks.	1
Never had science.	3	Doing experiments.	4
Everything.	3	Animal houses.	2

5. What didn't you like about science?

Only 10 minutes, not enough time.	2	Studying hard stuff.	4
Liked it all.	8	Reading.	4
Flower studies.	1	Not enough time to finish the papers--had to stay in for recess.	1
Writing reports.	6		
Nothing.	6		

6. What would you like to study in science this year?

Animal bodies, their eyes, how they work.	1	Caterpillars.	4
Hippopotamuses.	1	Rabbits.	8
Dinosaurs.	1	Fish.	3
All animals and outer space.	1	Frogs.	2
Cats.	2	Doves.	2
		Lizards.	1
		Dogs.	6

APPENDIX B

TEACHER SURVEY QUESTIONNAIRE RESULTS

Appendix B

Teacher Survey Questionnaire Results
Science Curriculum

1. Please rate the academic subjects from most important (#1) to least important (#5).

Teacher	Math	Reading	Social Studies	Science	Language Arts
1	2	1	4	5	3
2	2	1	4	5	3
3	3	1	4	5	2
4	2	1	4	5	3
5	2	1	4	5	3
6	2	1	4	5	3
7	3	1	4	5	2
8	2	1	4	5	3
9	2	1	4	5	3
10	3	1	4	5	2
11	3	1	4	5	2

2. List the subject that you as a professional feel least prepared to teach.

Science	9
Social Studies	2
Math	1

(One teacher chose 2 subjects.)

3. Please list some concrete suggestions to help improve the science instruction in our setting.

Inservice programs	More materials
Separate science room	More planning time
Hiring a teacher to teach only science	Team teaching

4. Please list the number of minutes you provide for science instruction each week.

20 minutes	1	60 minutes	1
30 minutes	8	I do not have time to teach science with my teaching load this year	1
45 minutes	1		

APPENDIX C

TEACHER EVALUATION CHECK LIST AND SCORING KEY

Appendix C

Teacher Evaluation Check List

		Usually	Seldom
1.	Does this teacher have the attention of all his/her students?	_____	_____
2.	Does this teacher provide a variety of teaching methods in one activity?	_____	_____
3.	Does this teacher read educational magazines to enrich his/her science teaching?	_____	_____
4.	Does this teacher allow children to do extra work in areas of science that they are interested in?	_____	_____
5.	Does this teacher provide hands-on activities in each class?	_____	_____
6.	Does this teacher provide visual aids to reinforce his/her unit study?	_____	_____
7.	Does this teacher research field trips to enrich his/her unit of study in science?	_____	_____
8.	Are this teacher's students enthusiastic about science class?	_____	_____
9.	Can this teacher's students predict what science class will be like or are they often surprised?	_____	_____
10.	Does this teacher design follow-up activities to reinforce his/her classroom instruction?	_____	_____

Appendix C

Teacher Evaluation Check List
Scoring Key

	Usually	Seldom
1.	10	5
2.	10	5
3.	10	5
4.	10	5
5.	10	5
6.	10	5
7.	10	5
8.	10	5
9.	10	5
10.	10	5
	100%	50%

APPENDIX D

WEEKLY LOG

Appendix D

Weekly Log
(Significant events and/or responses)

January 5:
Many students had volunteered to care for animals over vacation. Felt it wise to leave them in the Science Center because of transporting in winter temperatures.

January 19:
Open House night--parents visited each classroom as well as the Science Center (no babies yet)!

January 26:
Doves hatched--first time. Received note from Mrs. Boulden (a school mother) saying they had "Dawes' doves for dinner," expressing her son's excitement of the science studies.

February 2:
5 finch eggs (4 hatched).

February 9:
Surprise birthday party--2nd graders; bird hats, bird cake, cards from 1st graders during science class.

February 16:
4 parents asked if they could visit the Science Center that they had heard about.

February 23:
1st litter of rabbits born, 2; 1 died.

March 2:
1 dove hatched.

March 9:
4th and 5th grade teachers asked me if their classes could come to the Science Center to see the animals and understand what was going on. Each class was scheduled for a visit.

March 16:
Writer took the baby rabbit to spend one day in each primary class in a large aquarium. Language Arts activities were developed in 3 classes that day.

March 23:
Principals' luncheon held at my school. Area principals toured the Science Center; showed enthusiasm.

March 30:
4th grade classroom set up aquarium and bought a rabbit.

April 6:
2 doves hatched.

April 13:
Vacation week

April 20:
Librarian became involved and very generous with old magazines for reports. 2nd litter of rabbits born.

April 27:
6 finch eggs; 5 hatched. Mollie's had 6 babies on the way home from the pet store!

May 4:
2 teachers presented workshop at Spring Convention related to science studies. Mammal week.

May 11:
1 baby finch died. Kindergarten--gerbils had babies; all science classes went to see them.

May 18:
Spring Program practice. Teachers requested that we reschedule science class as their students would be upset.

May 25:
One 4th grade class asked again to visit the Science Center and see the new litter of bunnies and baby finches. (It seems the children have shared the happiness in the Science Center with the older students in the school.)

June 1:
Select children to take home animals for the summer.

June 8:
During our last class, 78 "thank-you" letters were received from the students in 2nd grades for appreciation for the science instruction given; favorite animals mentioned, the most were the baby bunnies.

June 14:
Pets sent home with 7 primary children:

Joel - 2 finches	Jason - cockatiel
Elizabeth - 2 doves	Jeff - cockatiel
Alana - rabbit	Aaron - finch
Andrea - rabbit	

June 16:
2 doves hatched

July - All 7 students reported to the writer by a phone call on the progress of their new pet. Two parents wrote letters of appreciation for their new rabbit and cockatiel.

August 18:
4 out of 7 students came over to the writer's home to see his aviary and bird collections. One pet was sadly returned because a family member had allergies. This student was very disappointed.

August 26-27:
The writer visited 2 students' homes to see how the pets were doing.

New Setting

August 28:
Present Animal Studies at inservice meeting.

September 8:
Begin dove study.

October 3:
2 dove eggs laid; Open House--parents learned about the animal studies and wanted to see the doves.

October 4:
Finches were introduced; study continues throughout the month.

November 1:
Rabbits introduced; dwarf bunny due to have babies Dec. 3.

November 20:
Received responses from Enrichment Program Questionnaire.

APPENDIX E

MONTHLY TIME SHEET FOR SCIENCE INSTRUCTION

Appendix E

Monthly Time Sheet for Science Instruction

Teacher's Name _____

Month	Date	Mins./Instruction
December	average/per week	90 minutes
January		75 minutes
February		75 minutes
March		75 minutes
April		90 minutes
May		60 minutes
June		60 minutes

APPENDIX F

LESSON PLANS FOR PRIMARY SCIENCE INSTRUCTION

Appendix F

Lesson Plans for Primary Science Instruction

NAME: K. Noel

WEEK OF: 2/19

OBJECTIVES:

Metamorphosis of Insects

To understand the complete metamorphosis of the Monarch Butterfly

MATERIALS:

Film: Monarch Butterfly
Textbook p 134-137
Make Butterfly notebook
Label all Stages

PROCEDURES:

I. Introduce Topic
View film
Study chapter
Drawings
Complete notebook.

APPENDIX G

SIGN-UP SHEET FOR SCIENCE CENTER

APPENDIX G

SIGN UP FOR SCIENCE CENTER

DATE January	TEACHER NAME	TIME IN	TIME OUT
1/2	O Linton	1:00	1:40
1/	K.M.	11:00	11:45
1/4	Y.J.	9:00	9:40
1/4	N.P.	9:00	9:30
1/13	P Lewis	10:15	10:45
1/14	L.J.	10:	10:45
1/15	K.M.	11:00	11:45
1/17	C.J	1:00	1:45
1/17	D.D.	2:00	2:45
1/20	D.H	8:45	9:15
1/20	A.P.	9:30	10:15

APPENDIX H

SAMPLE UNIT TEST

Appendix H

Sample Unit Test

Name _____

Date _____

Doves - Unit Study

1. Name 4 types of doves.

   _____ _____

   _____ _____

2. Where are the primary feathers located?

3. Why do doves need gravel in their diet?

4. Are doves an endangered species?

5. How many eggs does a dove lay?

6. Do male doves care for their young?

7. How many weeks does it take to incubate a dove's egg?

8. What happens when a dove molts?

9. The dove is known as the symbol of _____.

10. Doves should always be kept in a heated house.

    True _____

    False _____

APPENDIX I

STUDENT PRE AND POST-CHECK LIST

Appendix I

Student Pre and Post-Check List

Name _____

Date _____

		Yes	No	Sometimes
1.	I like science.	192	10	8
2.	I would like to spend more time studying science.	172	31	7
3.	I would like to spend less time studying science.	126	82	2
4.	I think science is an important subject.	154	56	0
5.	I would like to have a career in science when I grow up.	127	81	2
6.	I get good grades in science.	163	40	7
7.	I like the way my teacher teaches science.	156	46	8
8.	I enjoy reading more than science.	170	36	4
9.	I enjoy math more than science.	126	81	3
10.	I talk to my parents about what we are studying in science.	149	40	21

Appendix I

Preferred Responses to Check List

1. Yes
2. Yes
3. No
4. Yes
5. Yes
6. Yes
7. Yes
8. No
9. No
10. Yes

APPENDIX J

COMMENTS FROM TEACHERS' VISITATIONS

Appendix J

Comments from Teachers' Visitations

(The writer allowed the teachers to select the time for his visitations.)

Teacher	Date	Lesson Plans	Observation Comments
A	1/20/87	X	Insects; ant farm
	4/ 4/87	X	Air unit; classes outside; all blew up balloons; helium balloons also
* B	1/ 2/87	X	Senses; tasting lessons; eyes covered; sweet/sour
	4/ 6/87	X	(all hands-on experience-oriented)
* C	1/23/87	X	Drew projects of senses and purposes--eyes, ears, nose
	4/21/87	X	mouth, hands
D	2/ 3/87	X	Plant projects; photosynthesis; hands-on; planted cuttings
	4/23/87	X	Leaf identification (collected leaves outside)
E	2/ 4/87	X	Manual project reports (oral presentations); parents invited; combined with other classes
	4/27/87	X	Plant project; chlorophyll; microscope from M.S.; bean sprouts
F	2/ 4/87	X	Temperatures (one month)
	5/ 5/87	X	Plant project; light, water, soil; without light, water
G	2/10/87	X	Wind project; made pinwheels outside (models)
	5/12/87	X	Muscles; how they work
H	2/12/87	X	Pond life studies
	5/19/87	X	Environments with glass; built a terrarium

* Teachers B and C team taught

APPENDIX K

ENRICHMENT PROGRAM QUESTIONNAIRE AND SUMMARY

Appendix K

Enrichment Program Questionnaire

1. What was your attitude towards the writer's program when it was first presented at the beginning of the year?

   a. How do you feel now?

2. What responses did the children first have towards the animal science instruction?

   a. How do they feel now?

3. Has your knowledge increased from the animal science studies; if so, how?

4. Would you like to see this program continue throughout the school year; why?

5. What value do you see from the hands-on approach to teaching science?

Appendix K

Teacher Responses to the Enrichment Program Questionnaire (Summary)

1. Teacher 1: New and excited
   Teacher 2: Knew children would love animal studies
   Teacher 3: Looked forward to seeing new administrator teach
   Teacher 4: Welcomed additional enrichment
   Teacher 5: I love animals; grew up on a farm

1.a.
   Teacher 1: Very excited about each new animal
   Teacher 2: Favorable
   Teacher 3: Excellent program
   Teacher 4: Very enthused
   Teacher 5: Hope it continues

2. Teacher 1: Children very excited
   Teacher 2: Children wanted the pets for the classroom
   Teacher 3: Very interested in animals
   Teacher 4: Very excited to know more about animals
   Teacher 5: Excited after the first class

2.a.
   Teacher 1: Children are reading more animal stories
   Teacher 2: Love science
   Teacher 3: Favorite class each week
   Teacher 4: Very excited
   Teacher 5: Enthusiastic about science study

3. Teacher 1: Yes, never knew much about birds
   Teacher 2: Yes, want to get finches for my home
   Teacher 3: Yes, care and feeding of animals
   Teacher 4: Yes, all that animals have in order to survive
   Teacher 5: Yes, care of animals

4. Teacher 1: Yes, high interest
   Teacher 2: Yes, children love the classes
   Teacher 3: Yes, active learning, springboard for other activities
   Teacher 4: Yes, high interest for children
   Teacher 5: Yes, highlight of children's week

5. Teacher 1: Hands-on approach; active responses
   Teacher 2: Children really learn and remember
   Teacher 3: Using all senses; learning is fun
   Teacher 4: Children remember everything
   Teacher 5: Good skills for me to use in teaching all subjects in order to keep students interested